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NEW HAMPSHIRE COLLEGE
AGRICULTURAL EXPERIMENT STATION

CORN CULTURE

BY CHARLES WM. BURKETT

SHALLOW AND LEVEL CULTIVATION

NEW HAMPSHIRE COLLEGE
OF
AGRICULTURE AND THE MECHANIC ARTS
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AGRICULTURAL EXPERIMENT STATION

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CORN CULTURE

BY CHARLES WM. BURKETT

The total area devoted to the cultivation of maize or Indian corn in the United States in 1889 was a fraction over 51 per cent of the total cereal acreage of the country.

In New Hampshire, according to the last census, the total acreage in Indian corn culture was 23,746 acres with a production of 988,806 bushels, or an average production of 41 bushels per acre.

The prominent place the silo is taking in New Hampshire agriculture places this crop as one of the most important cereal products in the state. This, therefore, is an important subject with us, and anything that pertains to increased production in acreage and yield per acre is worthy of the most careful consideration. During the past season the following experiments in corn culture were conducted at this station:

A. Methods of Cultivating Corn.
   I. No Culture, Frequent, and Ordinary.
   II. Shallow and Deep Culture.
   III. No Culture, Mulch, and Ordinary.
B. Effect of Witch-Grass in Growing Corn.
C. Depth of Plowing in Reference to Corn Production.

A. CULTIVATION

In some of the principal corn growing states this matter has received considerable attention and some of the points have been practically settled. Many hold, however, that the conditions, differing as they do between the East and West, render

different methods of culture necessary. Our results of the past season, which was a phenomenally dry one, are decidedly in favor of shallow culture. In a table on a following page, we have grouped the tests of the several stations and classified them according to results favoring deep or shallow cultivation.

PREPARATION OF SOIL

One month after the corn was planted the experiments were begun. All plots were plowed November 12 and 13, 1898. The soil was a sandy loam, with good drainage, slightly sloping to the south and west. Before plowing it had been manured at the rate of 20 tons per acre. In the following spring it was harrowed with disc and smoothing harrows several times and rolled once.

At planting time it was in as perfect form as possible to make it. On May 12 it was planted to Leaming corn. All the plots received identically the same treatment; in fact, the area for the experiment was not divided into plots until one month after planting time. Up to that time all plots were cultivated alike. Five days after planting, a light smoothing harrow was run over to destroy the weeds that were germinating at or near the surface of the ground. This same operation was repeated at a later date, when the corn was all up and some of it an inch or more in height.

This culture gave the corn a good start over the weeds. Between May 24 and June 13 the weeder was used twice. The experiment proper began at the latter date, when the area was divided into plots of ten rows each, extending across the section of the field.

EXPLANATION OF PLOTS

Plot I. This plot during the remainder of the growing season received no culture at all. Weeds were permitted to grow and as freely as they would. It was a surprising fact to us, that even with the start the corn had, with all weeds kept out for a month, the latter soon caught up with the former in growth, and by the first of August there was a tangled mass of corn and weeds which continued until harvest time.

Plot II. During the growing season for fourteen times, or nearly every third day on an average, this plot received cultivation. The "Planet, Jr." cultivator was used and adjusted in this wise: on the two rear shovels a stick, two inches wide by three fourths of an inch thick and three inches shorter than the row, was attached. This left an inch and a half on each side between the end of the stick and the row of corn as the cultivator was drawn through. The soil rolled around the end of the stick as far as the corn, which produced the effect of fresh soil over the entire surface. The wheel at the front of the cultivator and the stick at the rear gave level and shallow cultivation.

Plot III. On this plot was hauled old swamp hay, which was carefully spread over the entire surface of the soil. This mulch averaged about three inches in thickness. No further attention was given to this plot during the remainder of the season. The mulch proved insufficient to keep all weeds down.

Plot IV. This plot received practically the same cultivation as Plot II, except that the cultivator was used but five times, where in the other it had been used fourteen. The stick was attached in the same way as for the second plot. Weeds were more aggressive on this plot because of the less frequent cultivations.

Plot V. The "Planet, Jr." cultivator was used on this plot, but the stick had been removed, the wheel in front raised, and the shovels were forced in as deeply as possible to put them. The depth was from four to five inches. In cultivating deep this way, the soil was ripped up, some roots were torn out, and the surface was ragged and ridged in a very broken way. However, the cultivation given was very similar to that practiced by hundreds of farmers in this state.

GROUP DIVISIONS OF PLOTS

The corn was not fully matured when cut, but frost had come and we could wait no longer. Then, too, we were obliged to husk and weigh the corn before it was fully air-dried. This,

of course, made the weighings slightly greater than they otherwise would have been, but the comparisons are just the same.

For convenience in comparing we have divided the methods of cultivation into the following groups:

I. No Culture, Very Frequent, and Ordinary.
II. Shallow and Deep Culture.
III. No Culture, Mulch, and Ordinary.

FIG. 9. THIS PLOT RECEIVED NO CULTURE

GROUP I.

KIND OF CULTURE.	Pounds corn stover.	Bushels shelled corn per acre.
No culture — weeds permitted	4,420	17.1
Very frequent — 14 times	12,016	80.6
Ordinary — 5 times	11,496	79.1

A glance at this table shows two important facts: First, that very frequent cultivations did not increase the yield in any perceptible way. A plot cultivated fourteen times pro-

duced 80.6 bushels per acre, while another cultivated but five times produced 79.1 bushels. This difference will in no wise meet the extra expense of labor.

Second, weeds grew at the expense of corn; where they were permitted to grow, but 17.1 bushels resulted, as compared with 80 bushels where they were kept out.

GROUP II.

Kind of Culture.	Pounds corn stover per acre.	Bushels shelled corn per acre.
Shallow—14 times	12,016	80.6
Shallow—5 times	11,496	79.1
Deep—5 times	9,874	69.7

From the above we see that deep culture was less productive than shallow. A difference of 10 bushels per acre is a matter of considerable importance. If deep culture were abandoned and shallow culture adopted by all, on the basis of this experiment, it would raise the average yield to 51 bushels and add 237,460 bushels to the total corn production in the state. When we consider the fact that the farmers of New Hampshire are bringing into the state several thousand bushels of corn annually, this matter becomes especially important.

In the following table we have grouped the tests of other stations that have experimented in reference to deep and shallow culture:

EXPERIMENTS IN DEEP AND SHALLOW CULTURE

STATION.	Total experiments.	Favorable to shallow.	Favorable to deep.	Not conclusive for either.
Alabama	3	3		
Georgia	4	1	1	2
Illinois	6	5		1
Indiana	9	7	1	1
Kansas	3	1	2	
Maryland	3	2	1	
Minnesota	3	2		1
Mississippi	2	1	1	
Missouri	2	2		
New Hampshire	1	1		
Ohio	7	5	2	
Oklahoma	2	1		1
Pennsylvania	1		1	
South Carolina	2			2
South Dakota	3	3		
Utah	1	1		
Wisconsin	4	1	3	
Totals	56	36	12	8

From this table, we see out of a total of 56 tests, 36 were in favor of shallow culture and but 12 in favor of deep culture. Some of the latter tests were but three inches of cultivation, and it is a question whether they should not be included in the shallow culture column.

GROUP III.

Kind of Culture.	Pounds corn stover per acre.	Bushels shelled corn per acre.
No culture	4,420	17.1
Mulch	11,024	56.1
Ordinary	11,496	79.1

In this table we have compared ordinary culture, no culture, and culture with mulch. An average yield resulted from the use of the mulch, due to the conservation of the moisture of the soil and the partial control of weeds. The latter grew to some extent, but nothing like in the no-culture plot. Wherever they grew they took water and plant food from the soil, and especially to a great amount where no culture was given. While a mulch conserves moisture in the soil and prevents to some extent the growth of weeds, it also keeps the soil shaded and cool, which are disadvantages in growing corn.

B. EFFECT OF WITCH-GRASS IN CORN PRODUCTION

The writer has had many inquiries in reference to the effect of witch-grass in growing corn. Every section of the state is troubled by this grass. It grows in pastures, meadows, and with all cultivated crops, spreading rapidly and holding on with a tenacity that is marvelous. It is particularly a nuisance in corn growing. Crops growing with an abundance of vegetation have a tendency to destroy it. We are told that ensilage corn has done this, but with us it has not been the case, and we have been obliged to resort to the hand hoe to keep our fields free of it, if the corn is cultivated but one way. Ordinary cultivators are hardly sufficient to keep it out where it has become firmly established for years.

We saw from the previous experiment that weeds or grass must be destroyed if maximum or even average crops are to be produced. There are three reasons for this: First, because

they consume plant food. If our soils were filled with an abundance of available plant food, in sufficient quantity for the growth of both corn and weeds, there would be no need of such a constant warfare against the latter. But our New Hampshire soils do not contain this abundance of available plant food. The necessity for commercial fertilizers is evidence enough that our soils do not contain even plant food enough for the growing of corn to maturity.

Second. Weeds keep sunlight and warmth from the soil. The mulched plot in the preceding experiment was underyield, not so much because a few weeds grew but principally because of the shade and lack of warmth. Weeds act in the same way; they shade the ground and keep the soil cool.

Third. Weeds are consumers of water. Insufficient moisture in the soil is often the only cause of a small crop. An abundance of water in the soil is necessary for the production of a maximum crop. If there is an insufficient amount of water in the soil the crop will be short; the more weeds in a field the larger the amount of water consumed.

Realizing the importance of these facts, the writer thought it advisable to see if an increased crop would result if witch-grass was kept out by the hand hoe, where the cultivator was unable to do so.

Two plots were laid off, the same in every respect. The soil was similar to that previously described. On May 9 the plots were planted to corn and were given the same cultivation until June 10. The preliminary cultivation consisted of two harrowings after the corn was planted and the use of the weeder three times. On June 10 both plots were cultivated with "Planet, Jr." cultivator. Witch-grass was quite prominent at this time. One of the plots was immediately gone over with the hand hoe, not as a cultivator but simply to destroy the grass. On June 21, July 5, and July 20 the same operations were repeated. During the summer the hoed plot was entirely free of witch-grass, but the other plot was matted with it in the rows. The corn was cut and harvested with the following results:

EFFECT OF WITCH-GRASS IN CORN

Kind of Culture.	Pounds corn stover.	Bushels shelled corn per acre.
Hoed	11,843	81.6
Unhoed	9,188	61.4

CONCLUSIONS AND SUGGESTIONS

There is but one conclusion. Where soil is badly infested with witch-grass it is advisable to use the hoe if the horse cultivator is inadequate in destroying it.

In this experiment the increased yield paid for the labor many times. If instead of planting in drills, the method were changed to that of planting in hills, the cultivator could be run both ways, and practically all weeds and witch-grass could be destroyed.

Fig. 10. This Half was Plowed 5 in. Deep This Half was Plowed 3 in. Deep

C. EFFECT OF DEPTH OF PLOWING ON YIELD OF CORN

Twelve plots, three in a series, were plowed November 1, 1898.

Series A, 3 inches deep.
Series B, 5 inches deep.
Series C, 7 inches deep.
Series D, 9 inches deep.

These four series of plots were alike as far as could be made. All sloped to the west and south. The soil was deep and of average fertility. They were plowed with headland in center and open furrows at side between the plots. On May 12 all plots were planted to Leaming corn and harrowed. A few days after, the roller was used and in turn followed by the weeder twice. No difference was seen in the plots until about the middle of the season, when the deeper plowed plots showed a stronger and more vigorous growth. This was easily seen during the remainder of the season, for the difference could be detected easily by the eye.

The table below shows the results when the corn was put in the silo:

	Depth of Plowing.	Tons per acre.
A	Three inches deep	14.2
B	Five inches deep	26.2
C	Seven inches deep	29.4
D	Nine inches deep	28.2

We conclude from this experiment that for a deep soil, deep fall plowing is preferable to shallow fall plowing for corn.

PRACTICAL DEDUCTIONS FROM THE EXPERIMENTS

Plow the soil as deep as its character will permit. A shallow, impoverished soil cannot be plowed as deep as a deep, fertile one. A good seed bed is necessary, and the deeper the

plowing when the soil permits the better the preparation for planting.

If a soil is shallow, gradually deepen it by subsequent plowing. By going an inch deeper, for instance, each plowing, the soil can be deepened, improved, and enriched.

If the deepening process is attempted at one plowing, in a soil too shallow, it will be ruined for some time and the crop destroyed for the first season at least. After a depth for plowing has once been established, vary it slightly from time to time; otherwise, a layer at the bottom of the furrow will be formed of compacted and hardened soil, due to steps of horse and man.

FIG. 11. THIS PLOT WAS PLOWED 7 INCHES DEEP

II. Destroy the weeds. This necessitates cultivation, which should be done as often as necessary to keep out the weeds. The harrow, if used a few days after planting and again after the corn is up, will do much to put the corn ahead of the weeds. Follow with the weeder and cultivator often enough to destroy weeds. Where a soil is badly infested with weeds, plant corn in hills and rows so as to be able to cultivate both ways.

III. Cultivate the soil. This is done not only to kill weeds but also because tillage is manure. The stirring of the soil is one of the means of changing unavailable plant food into available form.

Cultivation also makes a mulch of the fine dry soil that contributes in a degree to conserve the moisture in the soil.